

Original Research

Decreased Case Volumes for Pediatric Orthopaedic Surgery Fellows during the Early Stages of the Coronavirus-19 Pandemic

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Abstract

Background: In the early months of the coronavirus disease 2019 (COVID-19) pandemic, elective procedures were suspended to reallocate resources, notably impacting 1-year surgical fellowship programs. The purpose of this study is to compare the case volume of pediatric orthopaedic surgery fellows during the pandemic's peak year to the years before and after.

Materials and Methods: Accreditation Council for Graduate Medical Education (ACGME) case log reports of key procedures in pediatric orthopaedic surgery were compared between the fellowship classes of 2018-2019 (pre-pandemic), 2019-2020 (peak pandemic), and 2020-2021 (post-peak pandemic). Both overall case volume and individual key procedures were analyzed for significant differences between each of the three class years.

Results: There was a significant decrease (−43.7 cases, −15.5%) in the overall number of key procedures completed by the fellowship class of 2020 compared to 2019 ($p=0.014$), with similar significant decreases in various individual key procedures (foot and ankle deformity, limb deformity, and soft tissue: transfer, lengthening, and release). In the subsequent year, there was a significant increase (+98.8 cases, +41.5%) in the average case volume for the class of 2021 ($p<0.001$), with significant increases in procedures for foot and ankle deformity, clubfoot, limb deformity, hip, and soft tissue: transfer, lengthening, and release. Additionally, the rebound in overall case volume for the class of 2021 surpassed the pre-pandemic caseload completed by the class of 2019 ($p=0.008$).

Conclusion: During the peak of the pandemic when elective cases were suspended, pediatric orthopaedic surgery fellows logged fewer surgical cases compared to the pre-pandemic class of 2019. While the case volume rebounded in the subsequent year, further research is needed to quantify the overall impact of the decreased caseload for the pediatric orthopaedic fellowship class of 2020.

Level of Evidence: Level IV

Key Concepts

- With the onset of the unprecedented COVID-19 pandemic, the ensuing shutdowns' effects on the training and case volumes of pediatric orthopaedic fellows remain unclear.
- This study quantified the change in case volume of pediatric orthopaedic fellows during the first year of the COVID-19 pandemic and identified a significant decrease of nearly 44 total cases (15.5%) performed by fellows of the graduating class of 2020 when compared to those who graduated in 2019.
- This study quantified the rebound in case volume for the fellows of the 2021 graduating class when compared to the graduates of the 2020 fellowship class.

Introduction

On March 11, 2020, the World Health Organization officially declared the coronavirus disease 2019 (COVID-19) a pandemic, which subsequently led to sweeping shutdowns across the globe in many industries.¹ In light of rapid resource reallocation, the American College of Surgeons recommended the delay of elective procedures, significantly impacting a large number of surgical subspecialties that rely heavily on elective operations, such as orthopaedic surgery.² The release of guidelines specific to orthopaedic surgery helped guide surgeons as well as clinicians in urgent care facilities in determining essential procedures. This decrease in elective procedures dramatically impacted many orthopaedic subspecialties, leading to decreases in case volume and a shift in residency and fellowship-level training. Fellows were most notably affected as the orthopaedic fellows in the class of 2019-2020 had one-third of their year-long program remaining when shutdowns began. Additionally, residency work-hour restrictions and increased operative supervision³ magnified the importance of postgraduate fellowship training,⁴ making this additional year of training a crucial time for enhancing technical skills in a desired field.

In addition to surgical case volume being impacted by the pandemic, there was a change in fellowship training programs themselves across several orthopaedic subspecialties. There was a prominent shift to utilizing virtual didactic sessions and conferences as well as surgical simulators in both resident and fellowship education during the peak of pandemic shutdowns.⁵⁻⁹ The transition to telemedicine and virtual patient interactions also contributed to the reduction in hands-on learning.⁵ Many residents and fellows were redeployed to off-specialty services, such as the intensive care unit and emergency department, in order to provide assistance in the essential aspects of patient care.⁸⁻¹⁰ It is clear that the orthopaedic fellow experience as a whole was profoundly impacted during this crucial time of training.

The COVID-19 pandemic has had significant impacts on medical specialties globally and, more pointedly, during its peak in 2020 when elective cases were on hold. It is important to understand the impact that the COVID-19 pandemic has had on fellowship training programs as they are limited to only 1 year and are meant to prepare surgeons for autonomous practice in highly specialized

surgical fields. The purpose of this study was to compare the operative volume of pediatric orthopaedic fellows during the peak of the COVID-19 pandemic to pre-pandemic times as well as to the year following the peak. Our hypothesis is that the fellowship class of 2019-2020 had a significantly decreased case volume compared to the classes of 2018-2019 and 2020-2021, as the 2019-2020 class was only two-thirds of the way through their program when the shutdowns began. We also predicted that there would be a significant increase in case volume in the 2020-2021 class compared to the 2019-2020 class, as children and adolescents resumed organized sports and returned to school as COVID-19 distancing precautions were reduced.

Methods

Each year, the Accreditation Council for Graduate Medical Education (ACGME) publicly reports annual case logs for all accredited pediatric orthopaedic surgery fellowship programs. This study used the ACGME combined case log for all accredited pediatric orthopaedic fellowships within the United States. This report provides descriptive characteristics (national average, standard deviation, minimum, median, and maximum) for the number of key procedures performed by fellows broken down by patient type (adult, pediatric, and combined). For the pediatric orthopaedic combined case log, the adult case log was not analyzed due to the minimal number of cases throughout the United States (< 5 total) each year. Key procedures included in this report were foot and ankle deformity (excludes club foot), clubfoot, limb deformity, spine deformity, trauma upper limb, treatment of supracondylar fractures, trauma lower limb, open treatment of femoral shaft fracture, hip (reconstruction and other, excludes developmental dysplasia of the hip (DDH)), soft tissue: transfer, lengthening, and release, and treatment of infection. Pediatric sports medicine case logs during the pandemic have been addressed previously.¹¹

ACGME reports for academic years 2018 – 2019, 2019 – 2020, and 2020 – 2021 were extracted and will be referred to as the 2019, 2020, and 2021 academic years,

respectively, for the remainder of this study. Student’s T-Test with a Bonferroni adjustment was used to compare combined mean caseloads of both the overall number of procedures and individual key procedures. This analysis has previously been utilized in recent orthopaedic literature.¹¹ Comparisons were performed to analyze for significant change in the average number of key procedures done between consecutive years and between the 2019 and 2021 academic years. A p-value < 0.05 was considered statistically significant. All data analysis was performed using Stata (Version 15.1, StataCorp, Durham, NC, USA).

Results

The number of fellows and fellowship programs varied slightly from year to year (Table 1). The average number of pediatric orthopaedic key procedures completed is depicted in Table 2. During the 2019 academic year, pediatric orthopaedic fellows completed a total of 281.6 ± 69 (mean \pm standard deviation) key procedures, compared to 238.1 ± 80 in the 2020 graduating class and 336.9 ± 99 in the 2021 graduating class. These data demonstrate a significant decrease in the number of total procedures (-43.7 cases, -15.5%) performed by fellows during the 2020 academic year compared to 2019 ($P = 0.014$). This decrease was immediately followed by a significant increase in case volume for the 2021 graduating fellowship class ($+98.8$ cases, $+41.5\%$) compared to the 2020 class ($P < 0.001$). Of note, this increase seen in the 2021 case volume significantly exceeded the pre-pandemic caseload seen in the class of 2019 ($P = 0.008$) by an average of over 55 key procedures ($+19.5\%$).

Table 1. Number of Fellows and Programs in ACGME Accredited Pediatric Orthopaedics Fellowship Training

Academic year	Pediatric Orthopaedics Fellowship	
	Number of Programs	Number of Fellows
2018-2019	19	37
2019-2020	23	38
2020-2021	19	34

Table 2. Annual Case Volume of ACGME-Specified Key Procedures for Pediatric Orthopaedics Fellows in the Graduating Classes of 2019, 2020, and 2021

Total Pediatric Orthopaedics Case Experience for Orthopaedic Surgery Fellows						
Type of Case	Year			T-Test Comparisons between Years		
	2019	2020	2021	2019 to 2020	2020 to 2021	2019 to 2021
Foot and ankle deformity (excludes club foot)	46.2 ± 28	31.9 ± 18	64 ± 51	0.010	< 0.001	0.070
Clubfoot	20.1 ± 24	13.3 ± 17	28.8 ± 41	0.160	0.036	0.274
Limb deformity	33.8 ± 17	26.7 ± 13	35.3 ± 20	0.046	0.032	0.734
Spine deformity	55.7 ± 39	46.9 ± 35	66.6 ± 75	0.307	0.151	0.440
Trauma upper limb	18.5 ± 8	20.4 ± 9	19.2 ± 10	0.338	0.594	0.745
Treatment of supracondylar fractures	20.9 ± 12	22.8 ± 12	23.2 ± 12	0.495	0.888	0.423
Trauma lower limb	22.5 ± 12	25.2 ± 13	25.8 ± 10	0.353	0.828	0.215
Open treatment of femoral shaft fracture	5.4 ± 3	5.7 ± 3	6.2 ± 3	0.667	0.483	0.266
Hip (reconstruction and other, excludes DDH*)	36.9 ± 17	29.8 ± 14	40.2 ± 19	0.052	0.001	0.443
Soft tissue: transfer, lengthening and release	14.4 ± 15	8.3 ± 7	20.7 ± 24	0.026	0.003	0.185
Treatment of infection	7.4 ± 6	7 ± 8	6.9 ± 5	0.808	0.950	0.705
Total key procedures	281.8 ± 69	238.1 ± 80	336.9 ± 99	0.014	< 0.001	0.008

*DDH = developmental dysplasia of the hip. All bold values indicate statistical significance, *p* - value <0.05.

From the class of 2019 to 2020, individual key procedures for foot and ankle deformity (excludes clubfoot) (P=0.010), limb deformity (P=0.046), and soft tissue: transfer, lengthening, and release (P=0.026) significantly decreased. While there was an increased number of trauma-related cases (trauma upper limb, treatment of supracondylar fractures, trauma lower limb, open treatment of femoral shaft fracture) performed in 2020 compared to the prior graduating fellowship class, these increases did not meet the threshold for statistical significance. A significant increase was observed in the class 2021 compared to 2020 in key procedures for foot and ankle deformity (excludes club foot) (P<0.001), clubfoot (P=0.036), limb deformity (P=0.032), hip (reconstruction and other, excludes developmental dysplasia of the hip) (P=0.001), and soft tissue: transfer, lengthening, and release (P=0.003). There were no

individual key procedures with significant variation between the classes of 2019 and 2021.

Discussion

During the peak of the COVID-19 pandemic in 2020, there was a necessary shift in focus towards urgent and emergent cases that caused a temporary hiatus in elective procedures. This greatly impacted orthopaedic surgeons-in-training in several facets of their education. Specifically, fellowship training during this time deserves scrutiny as the shutdowns affected an entire third of their 1-year program. In pediatric orthopaedic fellows, specifically, the graduating class of 2020 saw a significant decrease in overall ACGME-defined key procedures as well as several individual key procedures. Subsequently, several individual key procedures, along with the overall caseload, rebounded significantly for

the pediatric fellowship class of 2021. These findings align with our hypothesis that the COVID-19 pandemic shutdowns negatively impacted the case volume for the 2020 graduating fellowship class, while the 2021 graduating class was relatively unaffected as the case volume quickly rebounded to pre-pandemic levels. Interestingly, the total case volume for the class of 2021 increased past the pre-pandemic levels seen for the class of 2019. However, the long-term impact of these fluctuations in case volume on the pediatric orthopaedic fellows, particularly those of the class of 2020, has yet to be elucidated.

The goal of this investigation is to understand the impact of the COVID-19 pandemic on the pediatric orthopaedic fellowship class of 2020. Similar results of decreased case volume from the class of 2019 to 2020 have been found in other orthopaedic subspecialties such as sports medicine and total joint arthroplasty.^{11,12} This recurring theme raises questions regarding the adequacy of the training this graduating class received. Gibbard et al. surveyed pediatric orthopaedic surgeons globally and found that most respondents who engaged in teaching or training activities during the pandemic felt as though they lost learning opportunities.⁵ This sentiment, in addition to worries about surgical autonomy and anxiety around future career plans, was common amongst other orthopaedic fellowship programs.^{6,9,13} In a recent study published by Swiatek et al., one third of the orthopaedic sports medicine fellowship class of 2020 voiced concern regarding their readiness for independent practice.¹³ Kogan et al. reported that many orthopaedic surgeons-in-training expressed concerns regarding several aspects of medicine outside of immediate clinical care, like graduation requirements, board certifications, and job prospects.⁶ Orthopaedics was not the only surgical subspecialty negatively impacted by the pandemic. Akin to the decrease seen in the case volume of various orthopaedic subspecialties, there were reports of significant decreases in the case volume for interventional radiology fellows, decreases in both didactical and practical training in plastic surgery programs, decreases in both clinical and surgical time

for urology residents, and a 74% decrease in the case volume for vascular surgery trainees.^{7,14-17} As such a large number of surgical trainees were affected by the pandemic, it is important to further understand the preparedness of those now attending level surgeons as they navigate practice in their respective specialties.

The recommendation to delay elective procedures at the peak of the pandemic likely played the greatest role in the decreased case volume seen in the class of 2020. Additionally, within pediatric orthopaedic surgery specifically, the simultaneous closure of school and cancellation of various sporting events likely impacted the overall case volume. The incidence of pediatric fractures dramatically decreased globally during the peak of COVID-19 compared to pre-pandemic times.¹⁸ As adolescent fractures often occur in the setting of sports-related injury and increased physical activity,¹⁸ the decreased number of fractures seen in the early stages of the pandemic is consistent with the social distancing recommendations in place during that time. There was also a relative increase in fractures diagnosed amongst skeletally immature preschool-aged children compared to school-aged children,¹⁸ which is also consistent with a decrease in organized sport injuries amongst the older children. Similarly, at a single level I trauma center, Bram et al. found a 2.5-fold decrease in pediatric fractures in which they also attributed to the decrease in organized sports and playground use.¹⁹

Interestingly, this study showed that the class of 2020 performed a slightly increased number of trauma-related procedures compared to the class of 2019, although not to a statistically significant degree. Speculatively, this may reflect fellows being assigned to more of the traumatic cases in an attempt to counteract the loss of experience due to decreased elective cases or a brisk return to activities following pandemic shutdowns leading to an increase in operative injuries. Bessoff et al. found a significant decrease in pediatric trauma across six centers in four states during the pandemic shelter-in-place, though they did see an increase in severity in the cases that presented.²⁰ Unlike other studies that report

increased rates of pediatric non-accidental traumas, there was no significant increase seen in incidence of those injuries in this study following the stay-at-home orders.^{21,22} The concern of an increased incidence of domestic violence during pandemic shutdowns was considered when it came to the increased number of each individual trauma-related key procedures found during the peak pandemic, but without the data showing a significant increase or enough previous literature to support this, it cannot be considered a major factor at this time.

In the field of pediatric orthopaedic surgery, many procedures consist of correcting congenital abnormalities or treating traumatic injuries. Once the pandemic began and elective procedures were being restricted, Farrell et al. released guidelines based on expert opinions from countries such as China, Singapore, and Italy that had already been impacted by COVID-19.²³ General recommendations were that nonsurgical procedures should be considered when possible and surgical procedures should be limited to urgent cases.²³ Specifically in treatment of developmental or chronic conditions, it was recommended that procedures be delayed 2-4 months.²³ This notion likely played a role in decreased key procedures of fellows during that time and may have contributed to the subsequent increase in procedures in the following year. Keshet et al. published a review that explored acceptable delays for the treatment of common pediatric orthopaedic conditions during the pandemic.²⁴ They categorized 25 common conditions into four categories of emergent, urgent, semi-elective, and elective based on how long procedures could be safely postponed based on previous literature.²⁴ Semi-elective and elective procedures were recommended to be delayed 3 months or 3-12 months, respectively,²⁴ and the significant decrease in case volume we found likely reflects this. Most elective and semi-elective procedures were delayed in order to protect clinicians from acquiring COVID-19 while treating patients, but Firth et al. was able to show that with careful protocols and proper personal protective equipment,

patients could still be successfully treated to avoid detrimental long-term outcomes that required more complex intervention, all while keeping patients and providers safe.²⁵ At a tertiary hospital in the United Kingdom, these authors prioritized the treatment of clubfoot, despite it being considered a semi-elective case and found that Ponseti casting was able to be completed successfully without a single COVID-19 case reported amongst patients or caretakers and only one case amongst the orthopaedic team.²⁵ This study demonstrated that there is an ability to address the needs of many patients safely, regardless of level of urgency, and may be helpful as practices continue to navigate care with the ongoing pandemic.

The significant increase found in key procedures between the classes of 2020 and 2021 is consistent with the resumption of elective procedures that were backlogged during the shutdown as well as with the return of children and adolescents to school and organized sports. It is also likely that a period of inactivity followed by a rapid return to higher levels of activity contributed to this finding, which was also a prediction made by Oh et al. in their pediatric fracture epidemiology review.¹⁸ Kong et al. acknowledged the necessity of an established protocol after a prolonged period of inactivity before returning to sport as it only takes 2-4 weeks for physiological changes to occur.²⁶ The study found a dramatic decrease in pediatric orthopaedic sports injuries during 2020 and similarly predicted an increase due to factors related to inactivity during that time.²⁶ This same notion of increased injury after an inactive period may also explain the significant increase seen between pediatric orthopaedic fellowship case volume in 2021 compared to pre-pandemic times.

In addition to the education of surgeons changing during the pandemic, surgical practice as a whole was greatly impacted, and recent literature suggests new implementations may be here to stay. A paper by Johnson et al. looked at the delivery of pediatric orthopaedic trauma care across North America during the pandemic and found substantial increases in telemedicine use, with

80% of respondents planning to continue its use moving forward.²⁷ Of all responding pediatric orthopaedic surgeons, 40% noted a change in timing or number of follow-up appointments with their patients.²⁷ They also found providers limiting follow-up appointments for patients to limit COVID exposure and most providers planned to continue this post-peak pandemic, which may lead to a movement towards reducing unnecessary clinical visits and overall cost savings for patients in the future.²⁷ Gibbard et al. found an uptick in telemedicine visits with an interest amongst orthopaedic surgeons globally to continue its use,⁵ and Peiro-Garcia et al. also found a 90% increase in patients seen over telemedicine in a pediatric orthopaedic clinic during that time.²⁸ It will be interesting to see how orthopaedic surgery practices carry on as the pandemic continues to subside and how this affects the surgeons trained by these new forms of practice.

There were several limitations in this study. First, when referring to pre-pandemic times, it is only in reference to the class of 2018-2019 and the years prior to this class were not included in analysis due to data accessibility. This limits the ability to generalize the procedures done in 2018-2019 to all of pre-pandemic times. Second, this study was only done using ACGME-accredited fellowship programs, which is an inherent limitation to the data source utilized. The ACGME-accredited programs only account for about 45% of the total number (46) of accredited fellowship programs. While this study did not include an analysis of all 46 programs, the ACGME-accredited programs likely provide a representative sample of all pediatric orthopaedic fellowships. Third, the case logs included in the data source are reliant on reports by fellows for their accuracy and completeness. These case logs also do not report on surgical outcomes or surgeon confidence during procedures. Lastly, while a reduction in case volume is presumed to have a negative impact on surgical training, there is not yet data to confirm this. Future studies are needed to elucidate the true impact this decrease had on the careers of pediatric orthopaedic surgeons in the fellowship class of 2020.

Additional Links

- POSNAcademy, [Starting Out Strong: 5 Tips for the New Orthopaedic Fellow](#)
- POSNAcademy, [5 Things to Do Now That You Matched Into a Fellowship](#)

Disclaimer

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References

1. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Available at: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>. Accessed June 17, 2022.
2. COVID-19: Recommendations for Management of Elective Surgical Procedures. American College of Surgeons. Published March 13, 2020. Available at: <https://www.facs.org/for-medical-professionals/covid-19/clinical-guidance/elective-surgery/>. Accessed June 16, 2022.
3. Mir HR, Cannada LK, Murray JN, et al. Orthopaedic resident and program director opinions of resident duty hours: a national survey. *J Bone Joint Surg Am.* 2011;93(23):e1421-e1429.
4. Horst PK, Choo K, Bharucha N, et al. Graduates of orthopaedic residency training are increasingly subspecialized: a review of the American Board of Orthopaedic Surgery Part II Database. *J Bone Joint Surg Am.* 2015;97(10):869-875.
5. Gibbard M, Ponton E, Sidhu BV, et al. Survey of the impact of COVID-19 on pediatric orthopaedic surgeons globally. *J Pediatr Orthop.* 2021;41(8):e692-e697.
6. Kogan M, Klein SE, Hannon CP, et al. Orthopaedic education during the COVID-19 pandemic. *J Am Acad Orthop Surg.* 2020;28:e456-e464.
7. Ramos O, Mierke A, Eastin M, et al. COVID-19 pandemic and the implications for orthopaedic and neurosurgery residents and fellows on spine rotations. *N Am Spine Soc J.* 2020;1:100006.
8. Liles JL, Danilkowicz R, Dugas JR, et al. In response to COVID-19: current trends in orthopaedic surgery sports medicine fellowships. *Orthop J Sports Med.* 2021;9(2):2325967120987004.
9. Perrone MA, Youssefzadeh K, Serrano B, et al. The impact of COVID-19 on the sports medicine fellowship class of 2020. *Orthop J Sports Med.* 2020;8(7):2325967120939901.
10. Sarpong NO, Forrester LA, Levine WN. What's important: redeployment of the orthopaedic surgeon during the COVID-19 pandemic: perspectives from the trenches. *J Bone Joint Surg Am.* 2020;102(12):1019-1021.
11. Testa EJ, Albright JA, Kutschke M, et al. Decreased case volume for orthopaedic sports medicine fellows during the early stages of the coronavirus disease 2019 pandemic. *Arthrosc Sports Med Rehabil.* 2022;4:e1347-e1352.
12. Silvestre J, Thompson TL, Nelson CL. The impact of COVID-19 on total joint arthroplasty fellowship training. *J Arthroplasty.* 2022;37:1640-1644.e2.
13. Swiatek PR, Weiner J, Alvandi BA, et al. Evaluating the early impact of the COVID-19 pandemic on sports surgery fellowship education. *Cureus.* 2021;13(1):e12943.
14. Ilonzo N, Koleilat I, Prakash V, et al. The effect of COVID-19 on training and case volume of vascular surgery trainees. *Vasc Endovascular Surg.* 2021;55(5):429-433.
15. Warhadpande S, Khaja MS, Sabri SS. The impact of COVID-19 on interventional radiology training programs: what you need to know. *Acad Radiol.* 2020;27(6):868-871.

16. Zingaretti N, Contessi Negrini F, Tel A, et al. The impact of COVID-19 on plastic surgery residency training. *Aesthetic Plast Surg.* 2020;44(4):1381-1385.
17. Amparore D, Claps F, Cacciamani GE, et al. Impact of the COVID-19 pandemic on urology residency training in Italy. *Minerva Urol Nefrol.* 2020;72(4):505-509.
18. Oh CH, Yoon S, Ko KR, et al. Epidemiology of pediatric fractures before versus during the coronavirus disease 2019 pandemic. *Clin Exp Pediatr.* 2022;65:330-336.
19. Bram JT, Johnson MA, Magee LC, et al. Where have all the fractures gone? The epidemiology of pediatric fractures during the COVID-19 pandemic. *J Pediatr Orthop.* 2020;40(8):373-379.
20. Bessoiff KE, Han RW, Cho M, et al. Epidemiology of pediatric trauma during the COVID-19 pandemic shelter in place. *Surg Open Sci.* 2021;6:5-9.
21. Kovler ML, Ziegfeld S, Ryan LM, et al. Increased proportion of physical child abuse injuries at a level I pediatric trauma center during the Covid-19 pandemic. *Child Abuse Negl.* 2021;116:104756.
22. Collings AT, Farazi M, Van Arendonk K, et al. Impact of “Stay-at-Home” orders on non-accidental trauma: a multi-institutional study. *J Pediatr Surg.* 2022;57(6):1062-1066.
23. Farrell S, Schaeffer EK, Mulpuri K. Recommendations for the care of pediatric orthopaedic patients during the COVID-19 pandemic. *J Am Acad Orthop Surg.* 2020;28(11):e477-e486.
24. Keshet D, Bernstein M, Dahan-Oliel N, et al. Management of common elective paediatric orthopaedic conditions during the COVID-19 pandemic: the Montreal experience. *J Child Orthop.* 2020;14(3):161-166.
25. Firth GB, Peniston W, Ihediwa U, et al. The effect of COVID-19 on children with congenital talipes equinovarus in a tertiary service in the United Kingdom. *J Pediatr Orthop B.* 2022;31:e101-e104.
26. Kong H, Feng J, McClellan C, et al. Pediatric orthopedic injury prevention for team sports post COVID-19. *J Family Med Prim Care.* 2022;11(3):833-838.
27. Johnson MA, Ganley TJ, Crawford L, et al. Pediatric orthopedic trauma care during the COVID-19 pandemic: a survey of the Pediatric Orthopedic Society of North America. *HSS J.* 2022;18(2):205-211.
28. Peiro-Garcia A, Corominas L, Coelho A, et al. How the COVID-19 pandemic is affecting paediatric orthopaedics practice: a preliminary report. *J Child Orthop.* 2020;14(3):154-160.